A Herpetofaunal Inventory of Arkansas Post, National Memorial, Arkansas County, Arkansas

FINAL REPORT

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Heartland I & M Network

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Introduction

Even relatively small National Park Service lands may provide potential refuges for amphibian and reptile species. The U.S. Congress passed the National Parks Omnibus Management Act in 1998 in response to concerns about the status of biodiversity in the nation's national park system. This act called for baseline inventory data for parks throughout the nation. Arkansas Post National Memorial (ARPO) in southeastern Arkansas (Arkansas County) was targeted as one of these areas lacking data.

Arkansas Post was designated as a national memorial in 1960. It spans approximately 302 ha (747 acres) of which 451 acres is federal land. The habitat is dominated by bottomland hardwood forest, backwater slough, and big river habitat. The surrounding land use is typical of the Mississippi Delta, being composed of rice and soybean production. Crop dusting is performed immediately adjacent to the park throughout the growing season. Recreational use at ARPO was estimated at 49,087 visitors in 1999. Nearly all the natural habitat in the Mississippi Delta has been modified/fragmented by agriculture. Habitat fragmentation and alteration have been implicated as primary factors influencing amphibian declines (Pechmann and Wilbur 1994, Blaustein et al. 1994) and biodiversity declines in general (Heywood 1995). Many amphibian and reptilian populations are best described as metapopulations (Levins 1969, Hanski and Gilpin 1991) whose stability is dependent upon a balance between population extirpation and recolonization (Johnson et al. 2002). Although the habitats at ARPO are not virgin lands, their setting in the Delta makes ARPO an important conservation area; thus, habitat management to limit disturbance may allow ARPO to act as ecological source for refueling adjacent populations (Wiens 1996). Despite its importance as a

biodiversity holding ground, little is known about ARPO's wildlife and plant communities.

In the spring of 2000 we undertook a short-term, herpetofaunal survey at ARPO with the cooperation of park personnel. Despite its small size, an array of amphibians and reptiles were found at the park at that time. Several species of turtles, lizards, and frogs were plentiful. The preliminary inventory resulted in four new county records for amphibians and reptiles at the park (red milk snake [*Lampropeltis triangulum syspila*], Graham's crayfish snake [*Regina grahami*], northern fence lizard [*Sceloporus undulates hyacinthinus*], and the marbled salamander [*Ambystoma opacum*]).

In response to a request for additional inventory work to be performed at ARPO by the National Park Service (NPS), we conducted a more thorough, one-year herpetofaunal survey in 2001-2002. This study attempted to identify at least 90% of the amphibian and reptilian species utilizing ARPO. The primary objective of this investigation was to provide an up-to-date assessment of species richness at the park. Secondary objectives involved the estimation of relative abundance, delineation of local ranges for each species, collection and deposition of voucher specimens, and the implementation of survey methods that would insure a 90% repeatability of the project.

Materials and Methods

We followed up our preliminary inventory, which was conducted from April 21-23, 2000, with a primary inventory which spanned from the fall 2001 through the summer 2002. Data from both surveys were combined for this report. Our primary terrestrial inventory methods included road cruising (Karns 1986) and general search and seizure activities (Vogt and Hine 1982). Aquatic methods included dip netting, seining (Karns 1986), and the use of minnow (Karns 1986) and turtle traps (Legler 1960). We employed a seven-member team during most visits. Most common and scientific names are based on Moriarty (2000).

We visited the park on 8-9 August 2001, 19-20 October 2001, 15 March 2002, 12-14 April 2002, and, 7-8 May 2002. A sampling grid of primary and secondary points for ARPO (Fig. 1) was designed for our use by the long-term ecological monitoring (LTREM) staff stationed at the NPS Heartland Inventory and Monitoring headquarters in Republic, MO. At each primary point on the sampling grid, four secondary points were identified in each of the primary compass directions from the primary point. Coverboard use was adapted from Grant et al. (1992). We alternately placed two wood and two tin coverboards at each point secondary point to account for potential differences in their quality as amphibian and reptilian attractants. Each coverboard plot was visited at least once during the study. Twelve of the 37 primary points were designated as coverboard plots, and time-area constrained searches (TACS) were used at 13 primary points. Eleven of the primary points were eliminated from the study because they fell outside the park boundary or in water bodies. Point 28 was near shore, so we placed cover boards along the shoreline at this sight. Both points 7 and 15 had a secondary point removed for

the same reason as described above. If a primary grid point appeared in a heavily wooded area, then coverboards were not applied, and we instead designated that point for TACS.

The TACS technique was a modification of the "time constrained search and seizure method" and the "quadrant search and seizure;" both methods were utilized by Campbell and Christman (1982). Four secondary points, designated as described above, were identified. An 8 m^2 plot was delineated at each secondary point and searched systematically for 10 minutes. All logs, rocks, and other debris were returned to their original position after turning. Each primary point was recorded using a Trimble GeoExporer 3 Global Positioning System (GPS) portable hand-held unit at the highest accuracy possible given the conditions at the time. No less than 150 data point readings were collected with the GPS for each primary point, and these saved as a single file for each grid point.

Generalized search and seizure methodology was utilized throughout the entire park in addition to the other two methods. All trails and east-west/north-south transects between coverboard plots were hiked. Both day and night road cruising were implemented each night on all park roads and on roads immediately adjacent to the park. Animals were recorded as encountered.

Turtle trapping was implemented in the vicinity of primary point 1 on 12-14 April 2002. The water depth in other locations was too shallow to adequately sample by this method. We placed two turtle traps near basking logs where turtles were observed. Dip netting was implemented in roadside ditches, Alligator Slough (AS), and in the Visitor Center Lake (VCL), and in a small backwater pond northeast of the VCL.

Spotlighting was used at AS and on the VCL to observe frogs and alligators. The eye-shine from these animals is easily seen using a spotlight or high-intensity flashlight. These lights are also helpful in capturing amphibians and reptiles at night because the light prevents the animal from seeing the investigator's approach.

In most cases, only a single voucher specimen of each species observed was taken during the primary inventory. These specimens were prepared for museum storage (body positioned and fixed in 10% formalin and then preserved in 70% ethanol following Pisani 1973). All specimens were deposited in the National Park Service Heartland Division Special Collection within the Arkansas State University Museum of Zoology herpetology collection. Specimens with their accession numbers were entered into an electronic Microsoft Access database for reference. A map of ARPO with all primary points and designated special areas (with labels) is shown in Fig. 1. ArcView 3.0 was the geographic information system (GIS) used to produce species maps and to analyze species richness throughout the park.

Results

The preliminary inventory yielded eight amphibian species (one salamander and seven anurans) and 21 reptilian species (one crocodilian, six turtles, five lizards, and nine snakes). The extensive inventory found eight additional species including three anurans, one salamander, two turtles, and two snakes. Six species were represented by a single observation/specimen. These were the marbled salamander (*Ambystoma opacum*), red milk snake (*Lampropeltis triangulum syspila*), green anole (*Anolis carolinensis*), rough green snake (*Opheodrys aestivus*), and the western slimy salamander (*Plethodon*

albagula). Species observed and their relative abundances are provided in Tables 1 and 2. Range maps for each species observed on the park are provided in Figs. 2-14.

Overall herpetofaunal species richness (Fig. 15) was highest at AS (vicinity of primary points 22 and 23) followed by VCL (vicinity of primary point 34). The northern two rows of primary points at the park were also relatively species rich. Amphibian species richness (Fig. 16) was highest at AS (primary points 22 and 23), at VCL (primary point 34), and in the vicinity of primary points 1, 6, and 7. Reptilian species richness centers are shown on Fig. 17 and appear to follow the general patterns of amphibian and total richness at ARPO.

Discussion

The most important habitat resource for herpetofauna in the park is the area surrounding and including AS. No other part of ARPO is nearly as rich. Species abundance in this area was also much higher than anywhere else in the park. Twenty-one species (Table 3) were found in this area, representing 57% of the total richness. Another seven species were observed close enough to AS to derive benefits from its habitats. This suggests that 76% of the amphibians and reptiles at ARPO may utilize the habitats of AS. Although they could not be identified, several basking turtles were observed swimming in AS. All seven turtle species observed at the park probably utilize this area to some extent. Six species of amphibians were observed at AS representing 50% of the amphibian species richness on ARPO. Twenty-two species of reptiles were observed at AS representing 88% of the reptilian species richness at the park.

At least one American alligator and its nest were observed within the area of AS. The single nest was first sighted on 7 August 2001 (Fig. 18). We counted 22 hatchlings

in the vicinity of the nest 10 months later on 7 May 2002. The hatchlings remained in close association with their nest for the next several months. A second pod of hatchlings was observed in the VCL around the same time, but the following spring none of these individuals was observed. This suggests that AS may be an important source habitat for American alligators. We observed populations of ghost shrimp in AS so dense that our dipnet contained nearly a liter of the invertebrates following one scoop on 7 August 2002. The abundance of ghost shrimp and other invertebrates in the waters of this location undoubtedly provides a rich, high-caloric diet to prepare the hatchlings for the winter months. This single factor may have been sufficient to relate the survivorship differences observed between the two pods during our study.

The high species richness at AS may also be due to lower levels of visitors in this area as compared to other parts of the park. Alligator Slough has only one small dirt footpath. Other areas have paved paths with mowed borders. This probably leads to heavier traffic and higher potential for human interaction with the wildlife. The natural attractiveness of AS makes it an important natural resource at ARPO.

The VCL provides an important resource for the herpetofaunal community of ARPO. Eleven species were observed here representing 30% of the total species richness at ARPO (Table 4). Diamondback water snakes were particularly abundant here. As mentioned previously, hatchling alligators were present here on 7August 2001, but were gone in April 2002. Eastern narrowmouth toads, northern cricket frogs, green treefrogs, bronze frogs, bullfrogs, and southern leopard frogs were observed calling at this location. Except for the eastern narrowmouth toad, all amphibians and reptiles present at the pond were essentially aquatic species. The pond is entirely surrounded by mowed lawn grass.

In most areas the grass is mowed to the water's edge. Human activity at this small lake is heavy. These factors may be suppressive to amphibian and reptilian populations that might otherwise inhabit the terrestrial habitats adjacent to VCL.

The forested areas at ARPO are highly fragmented. The largest tracts of forested land appear in the areas of highest species richness. A single species, the northern cricket frog, was observed in mowed areas away from the forest edge. Fewer than 10 of these frogs were observed in this habitat. Arkansas Post has large tracts of mowed habitat for human use distributed in the central region of the park. This creates an atoll-shaped forest habitat within this region. This type of habitat distribution is typically expected to possess lower than average species diversity (MacArthur and Wilson 1967).

The low richness and abundance of mole salamanders (family Ambystomatidae) are important to address. A single marbled salamander was recovered during the preliminary inventory from habitats adjacent to AS. No adults or larvae were observed during the entire primary inventory. In fact, no fishless ephemeral ponds are present at ARPO. Such ponds are essential for maintenance of mole salamander populations.

Species diversity is the variety of species present combined with their relative abundances. Species diversity is believed to decrease when ecological integrity is compromised (Feinsinger 2001). The use of species richness alone, without adequate consideration of relative abundance, can lead to inappropriate decisions regarding natural resource management (Feinsinger 2001). It is, therefore, important that continued long-term monitoring occur at ARPO in order to insure the accuracy and precision of the resultant data set supporting future decision-making. Our brief, one-year study is

primarily a species inventory and, except in a few cases, provides limited abundance information.

Management Recommendations

1) Construct up to five small, temporary wildlife ponds in forested areas to promote mole salamander populations.

2) Supplement currently depauperate marble salamander populations with egg clutches from nearby populations. This has high probability of restoring the park's populations.

3) Alligator Slough should be considered a special biological resource on the park and should be monitored routinely. Avoid human use improvements in this area.

4) Timber management should include a forest floor management plan so that sufficient logs, woody debris, and other refugia are available as amphibian and reptilian habitats. This should further include significant expansion of the forested areas on the park at the expense of the mowed lawn areas.

5) Establishment of a long-term, population monitoring plan for the park.

6) Alter human access and management by encouraging people to remain on the sidewalks, especially around VCL. An example of this may include posting warning signs for venomous snakes and alligators. These signs may discourage most people from entering the habitat proper. This would not prevent people from enjoying the visual beauty of such areas and would definitely contribute to its preservation over the long-term.

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Table 1. Amphibians of Arkansas Post National Memorial.

Key: (+++++) = Commonly encountered, (+) = Rare, (?) = unverified observation

Amphibia			Relative Abundance
Anura	Bufonidae	American Toad (*Bufo americanus*)	+++
		Fowler's Toad (*Bufo fowleri*)	+++++
		Northern Cricket Frog (*Acris crepitans*)	+++++
		Spring Peeper (*Pseudacris crucifer*)	+++
		Cope's Gray Treefrog (*Hyla chrysoscelis*)	+
		Green Treefrog (*Hyla cinerea*)	++++
	Microhylidae	Eastern Narrowmouth Toad (*Gastrophryne carolinensis*)	+++
	Ranidae	Bullfrog (*Rana catesbeiana*)	+++
		Bronze Frog (*Rana clamitans*)	++++
		Southern Leopard Frog (*Rana sphenocephala*)	+++++
Caudata	Ambystomatidae	Marbled Salamander (*Ambystoma opacum*)	+
	Plethodontidae	Western Slimy Salamander (*Plethodon albagula*)	?

Table 2. Reptiles of Arkansas Post National Memorial.
Key: (+++++) = Commonly encountered, (+) = Rare, (?) = unverified observation

Reptilia			Relative Abundance
Squamata	Phrynosomatidae	Northern Fence Lizard (*Sceloporus undulatus hyacinthinus*)	+++
	Scincidae	Five-lined Skink (*Eumeces fasciatus*)	++++
		Broadhead Skink (*Eumeces laticeps*)	+++
		Ground Skink (*Scincella lateralis*)	+++++
	Colubridae	Southern Black and Blackmask Racer (*Coluber constrictor*)	+++
		Speckled King Snake (*Lampropeltis getula*)	+++
		Red Milk Snake (*Lampropeltis triangulum*)	+
		Green Water Snake (*Nerodia cyclopion*)	+++++
		Yellowbelly Water Snake (*Nerodia erythrogaster*)	++++
		Broad-banded Water Snake (*Nerodia fasciatus*)	++++
		Diamondback Water Snake (*Nerodia rhombifer*)	++++
		Rough Green Snake (*Opheodrys aestivus*)	+
		Graham's Crayfish Snake (*Regina grahami)*	+++
		Western Ribbon Snake (*Thamnophis proximus*)	++
	Viperidae	Western Cottonmouth (*Agkistrodon piscivorus*)	++++
Testudines	Chelydridae	Common Snapping Turtle (*Chelydra serpentina*)	++++
	Emydidae	Common Map Turtle (*Graptemys geographica*)	++
		River Cooter (*Pseudemys concinna*)	+++++
		Three-toed Box Turtle (*Terrapene carolina triunguis*)	++++
		Red-eared Slider (*Trachemys scripta*)	+++++
	Kinosternidae	Common Musk Turtle (*Sternotherus odoratus*)	++
		Razorback Musk Turtle (*Sternotherus carinatus*)	++++
Crocodilia	Alligatoridae	American Alligator (*Alligator mississippiensis*)	++

Table 3. Species Richness at Alligator Slough.

Species	Inhabitant	Observed In Vicinity
American Alligator	X	
Black Racer	X	
Broad-banded Water Snake	X	
Broadhead Skink	X	
Bronze Frog	X	
Bullfrog	X	
Common Musk Turtle	X	
Common Snapping Turtle	X	
Diamondback Water Snake		X
Eastern Narrowmouth Toad		X
Five-lined Skink	X	
Graham's Crawfish Snake	X	
Green Treefrog		X
Green Water Snake	X	
Ground Skink	X	
Marbled Salamander		X
Northern Cricket Frog	X	
Northern Fence Lizard	X	
Razorback Musk Turtle	X	
Red Milk Snake		X
River Cooter		X
Southern Leopard Frog	X	
Speckled King Snake	X	
Three-toed Box Turtle	X	
Western Cottonmouth	X	
Western Ribbon Snake		X
Western Slimy Salamander	X	
Yellowbelly Water Snake	X	

Table 4. Species Richness at Visitor Center Lake.

Species	Inhabitant	Observed In Vicinity
American Alligator	X	
Bronze Frog	X	
Common Map Turtle	X	
Diamondback Water Snake	X	
Eastern Narrowmouth Toad	X	
Green Treefrog	X	
Northern Cricket Frog	X	
River Cooter	X	
Southern Leopard Frog	X	

Figure 1. Map of Arkansas Post National Memorial (ARPO) showing primary points and other search areas.

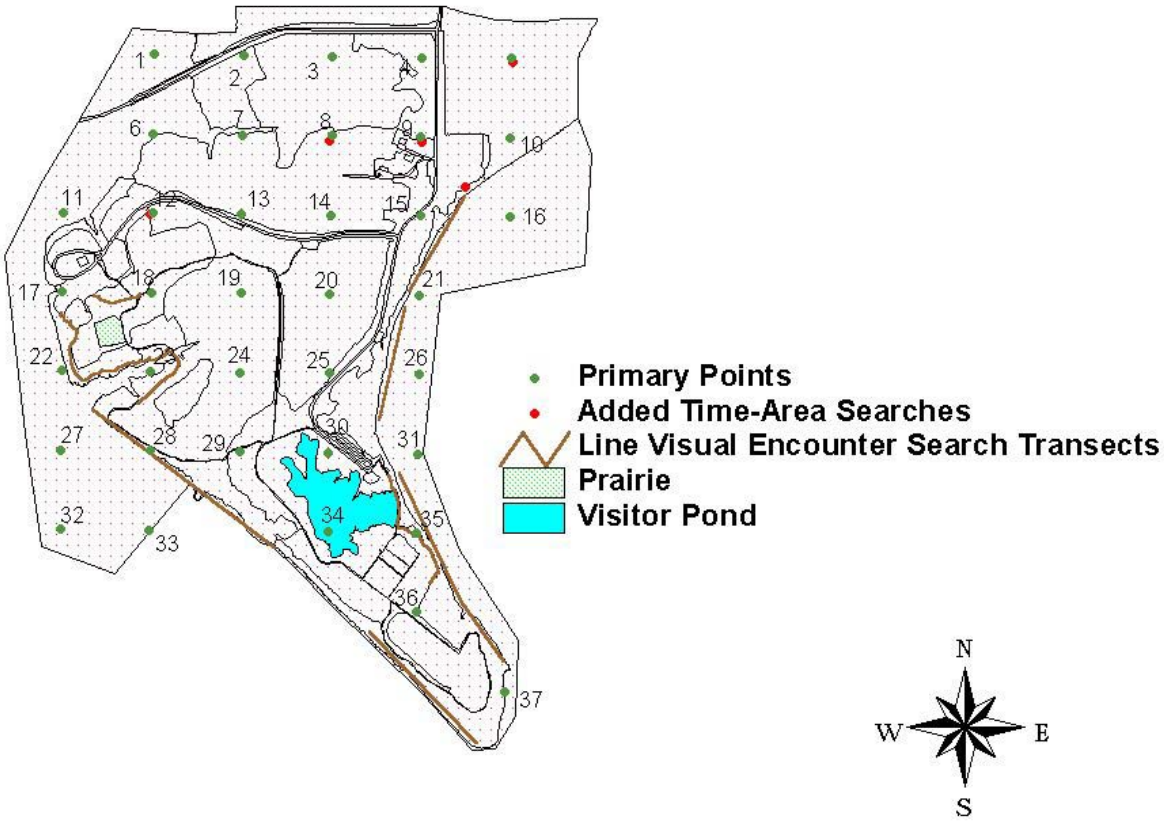

Figure 2. Distribution of the northern cricket frog at Arkansas Post National Memorial (ARPO).

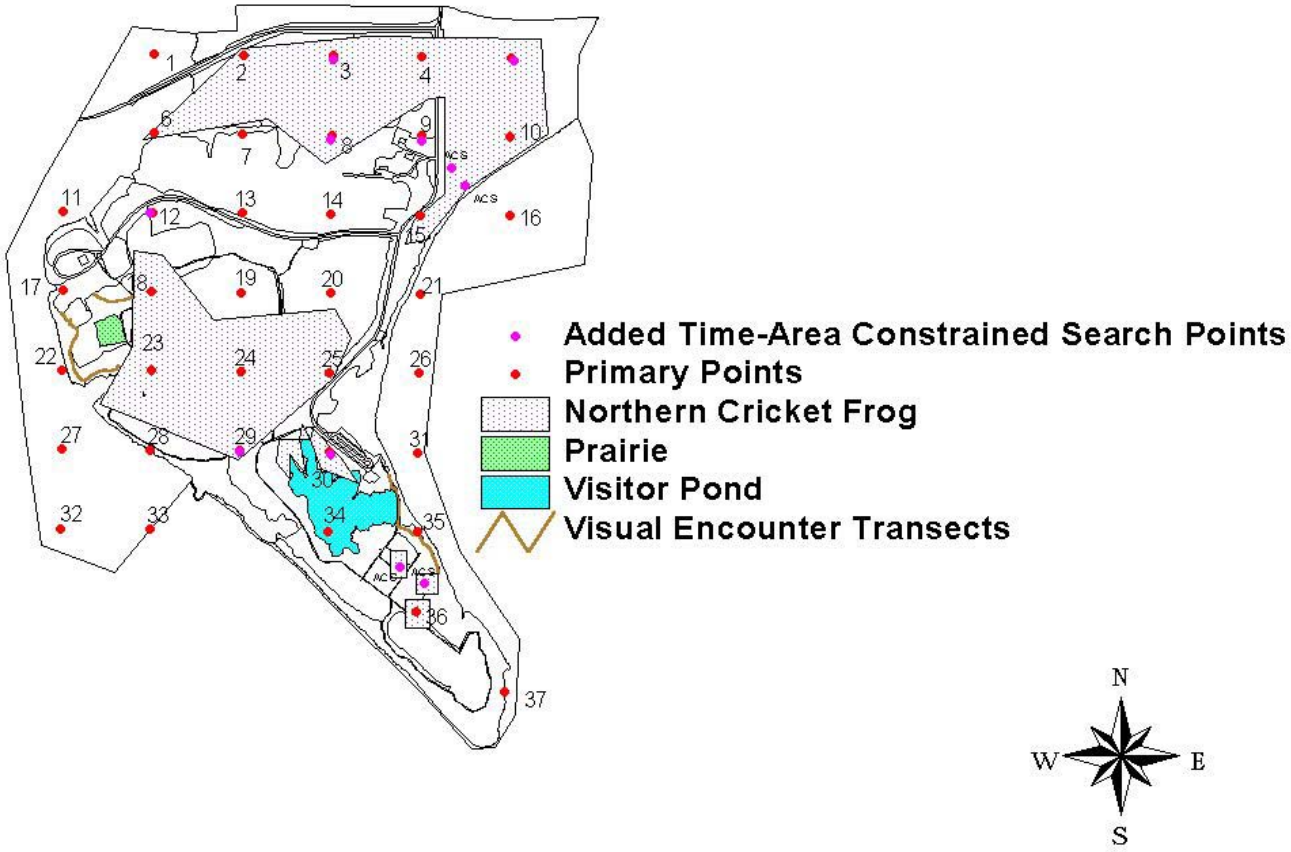

Figure 3. Distribution of the American alligator at Arkansas Post National Memorial.

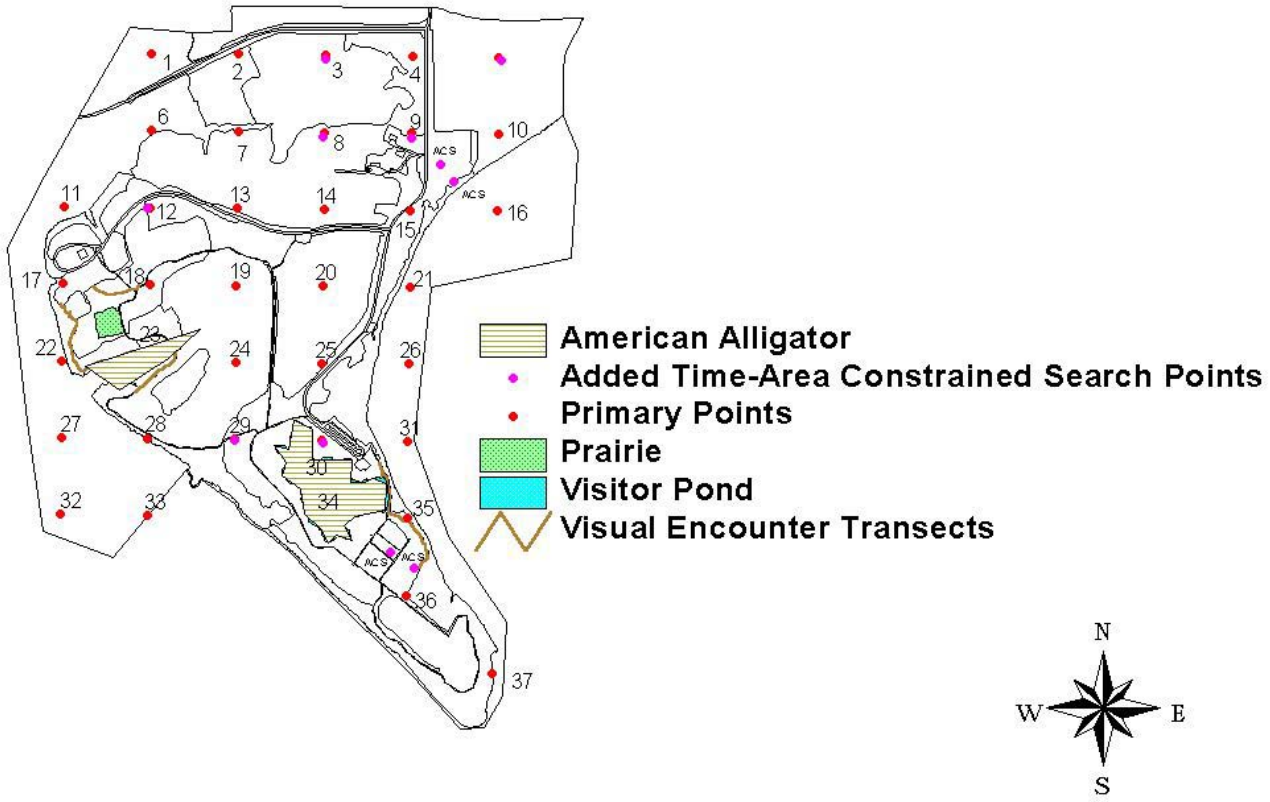

Figure 4. Distribution of three species of amphibians and reptiles at Arkansas Post National Memorial.

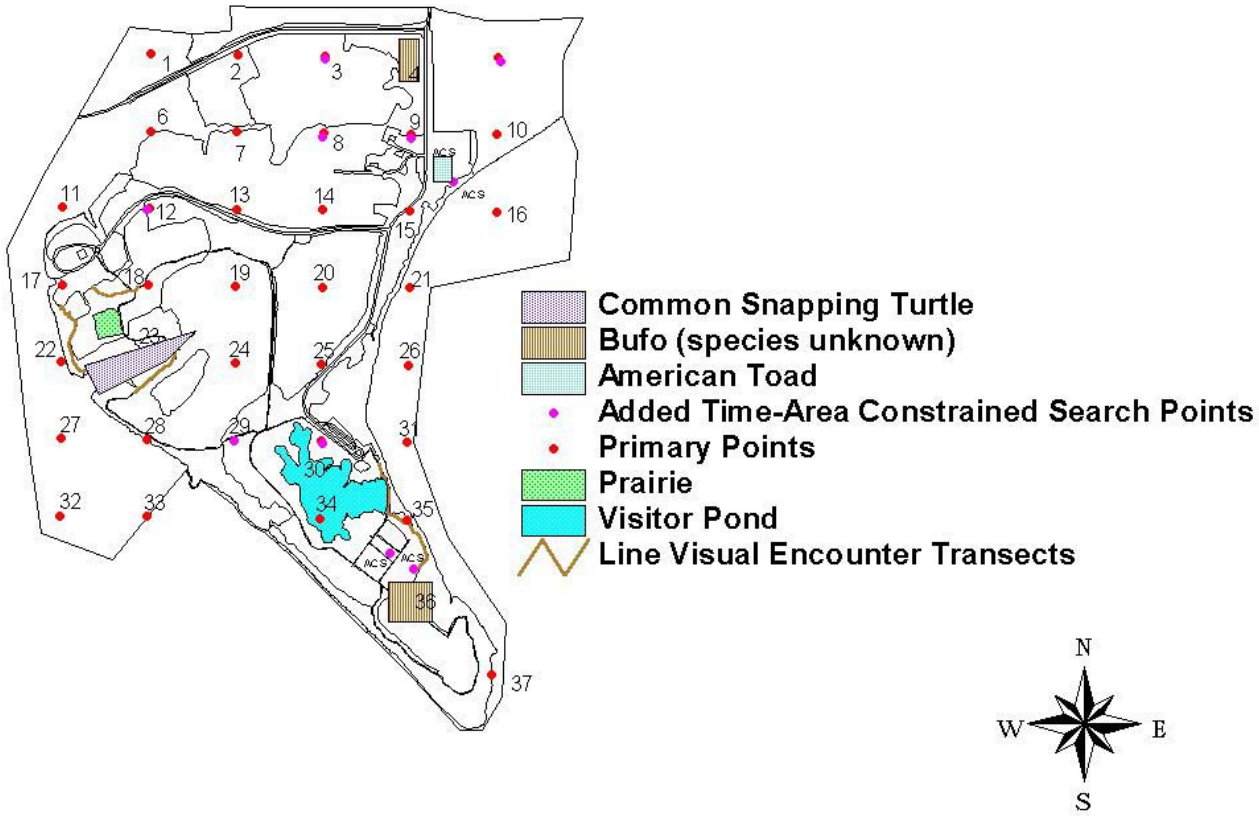

Figure 5. Distribution of five species of amphibians and reptiles at Arkansas Post National Memorial.

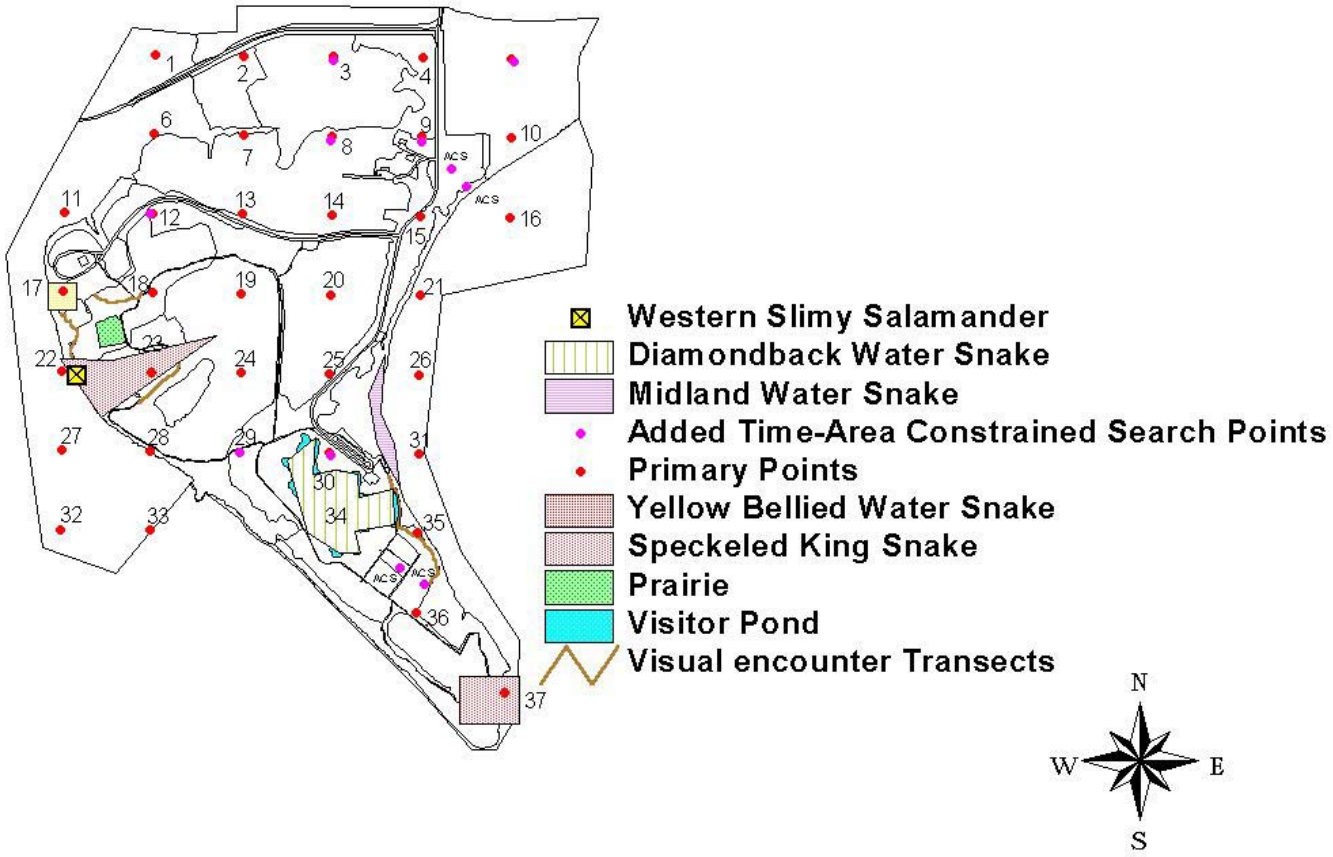

Figure 6. Distribution of the broad-banded water snake at Arkansas Post National Memorial (ARPO).

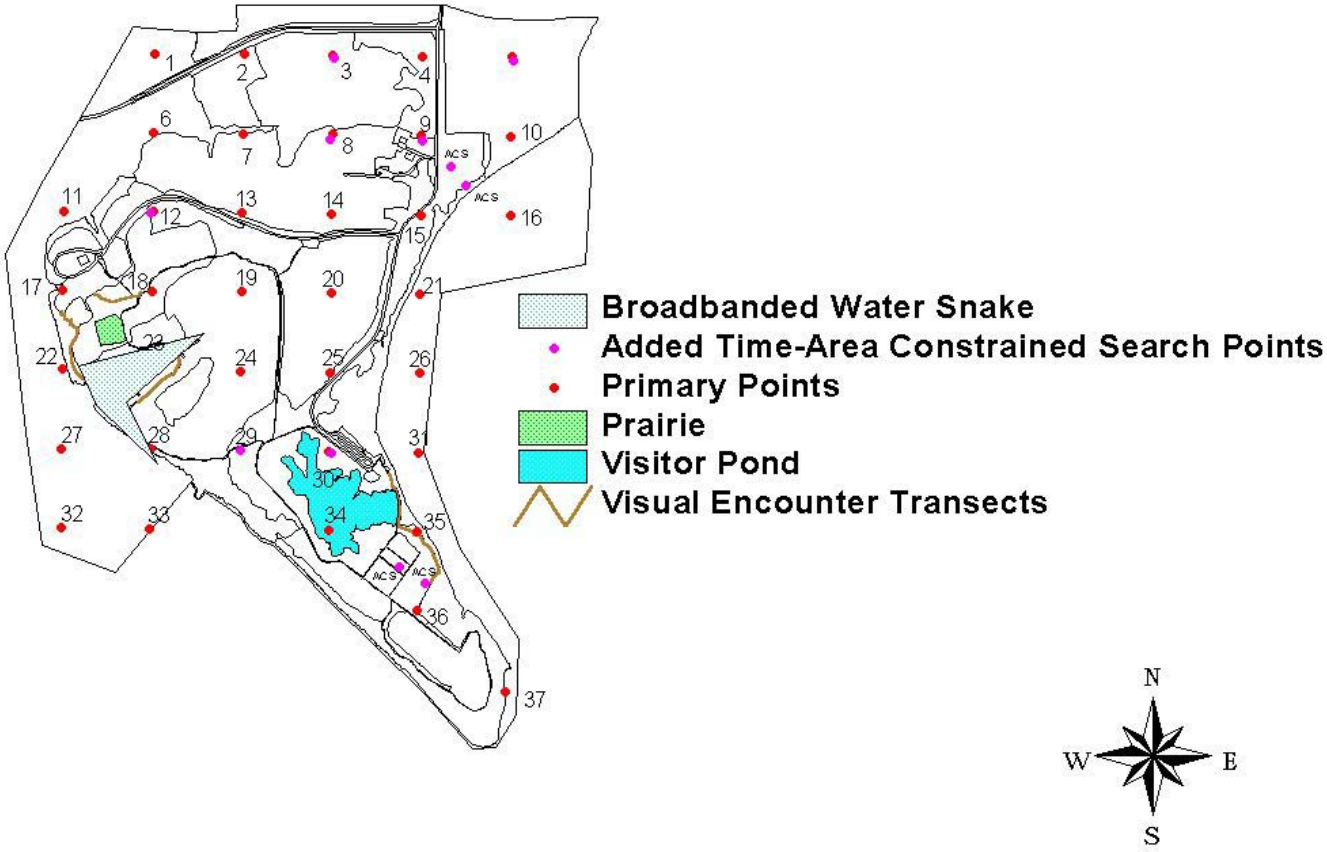

Figure 7. Distribution of nine amphibians and reptiles at Arkansas Post National Memorial (ARPO).

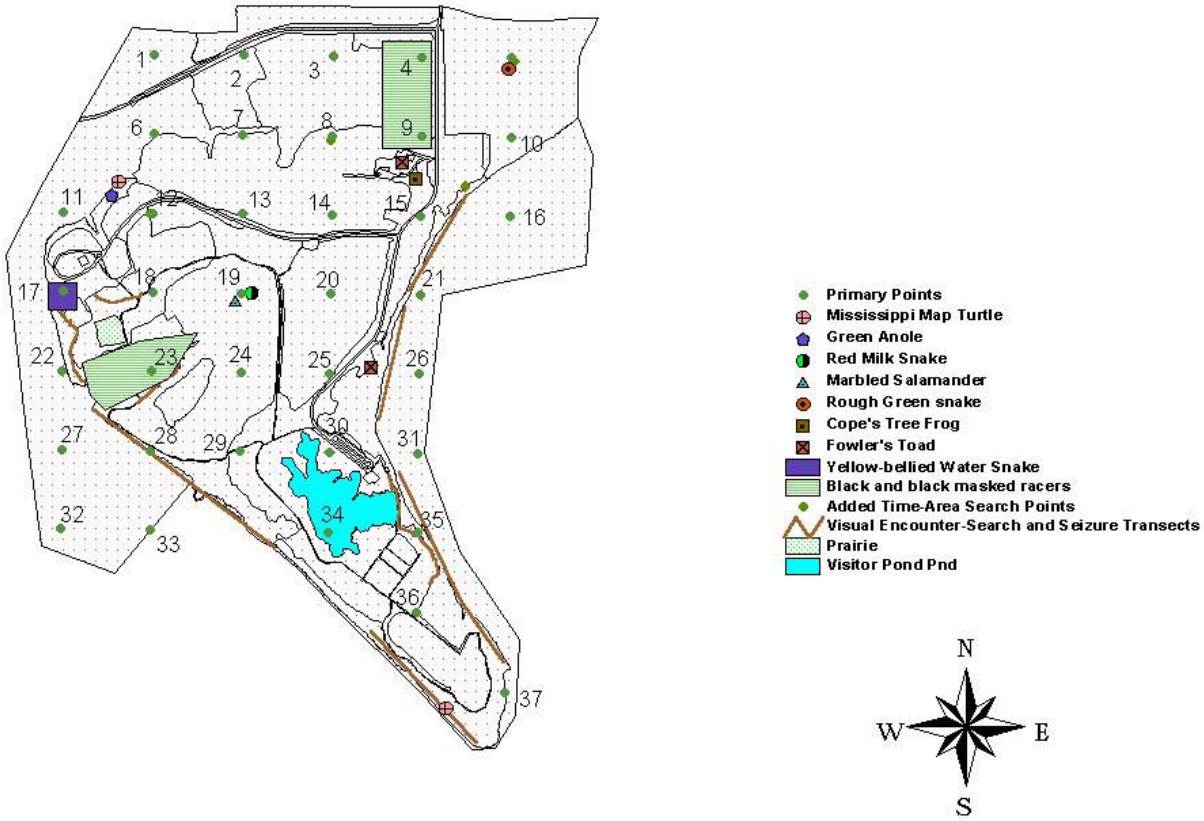

Figure 8. Distribution of five amphibians and reptiles at Arkansas Post National Memorial (ARPO).

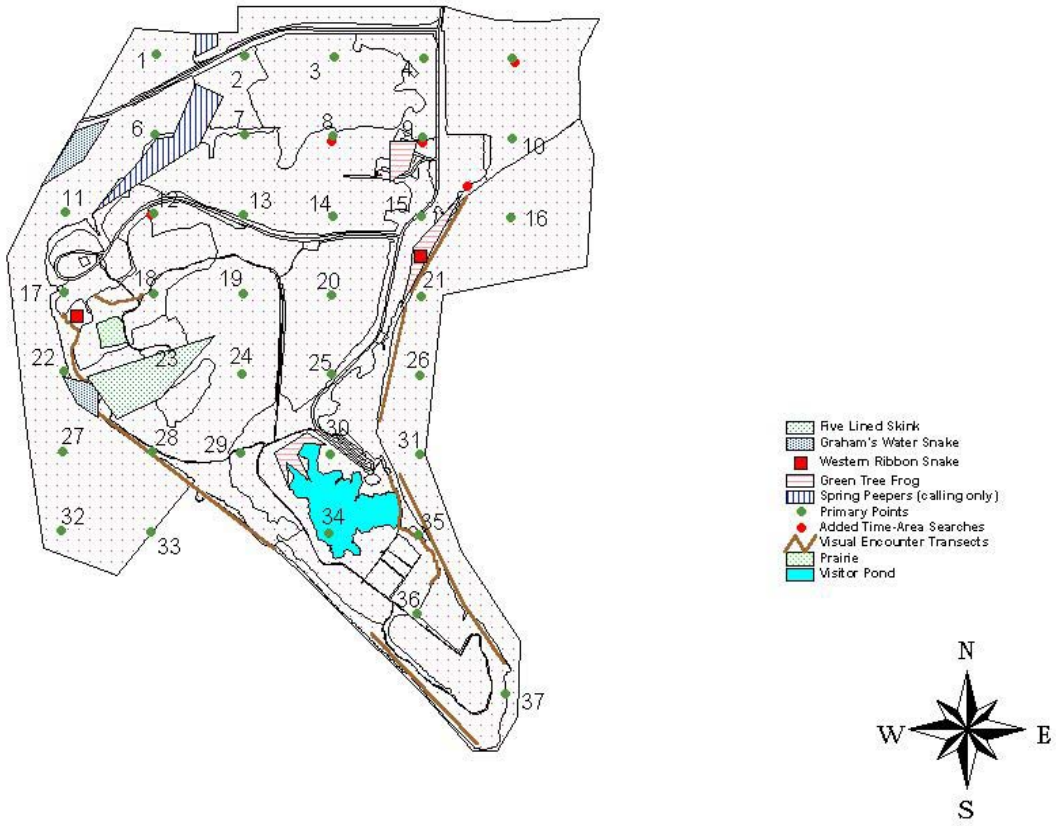

Figure 9. Distribution of three turtle species at Arkansas Post National Memorial.

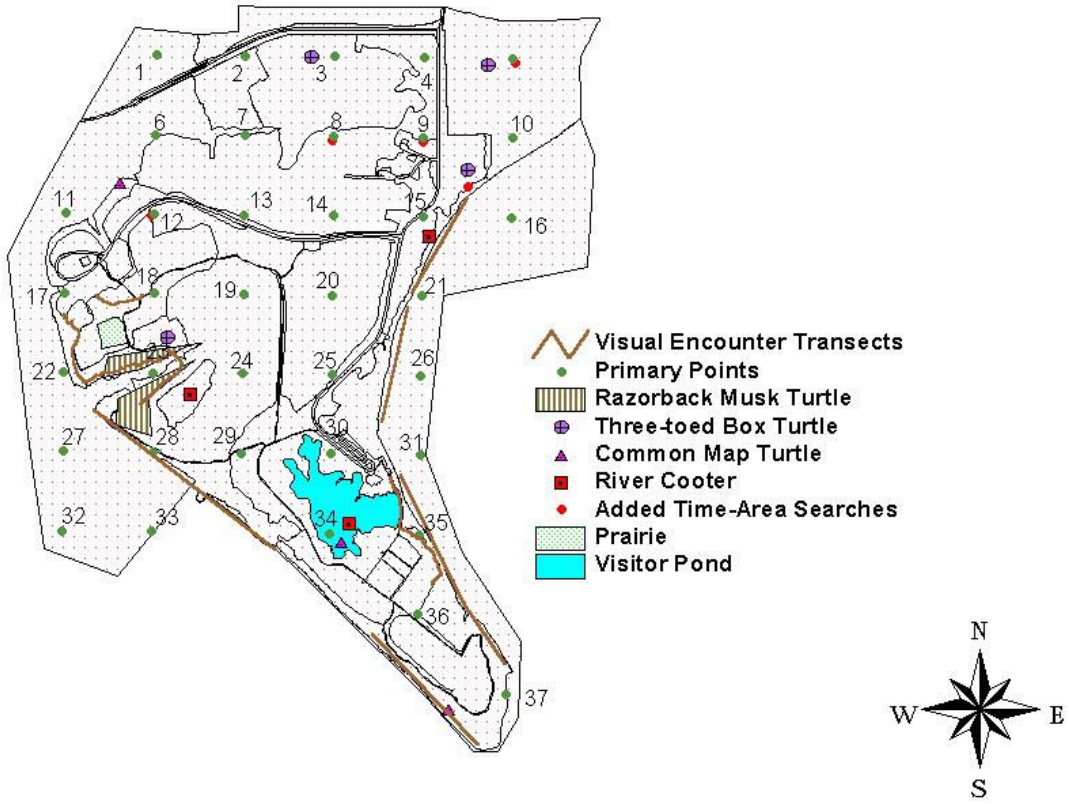

Figure 10. Distribution of three amphibians and reptiles at Arkansas Post National Memorial.

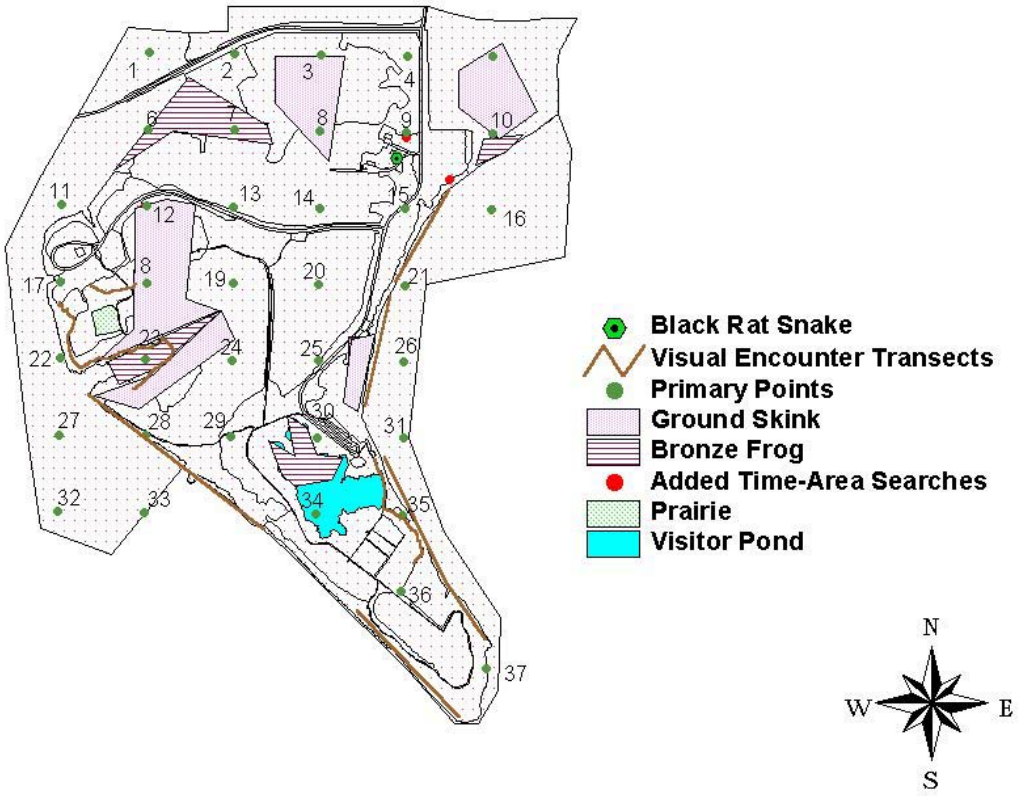

Figure 11. Distribution of the broadhead skink and the common musk turtle at Arkansas Post National Memorial.

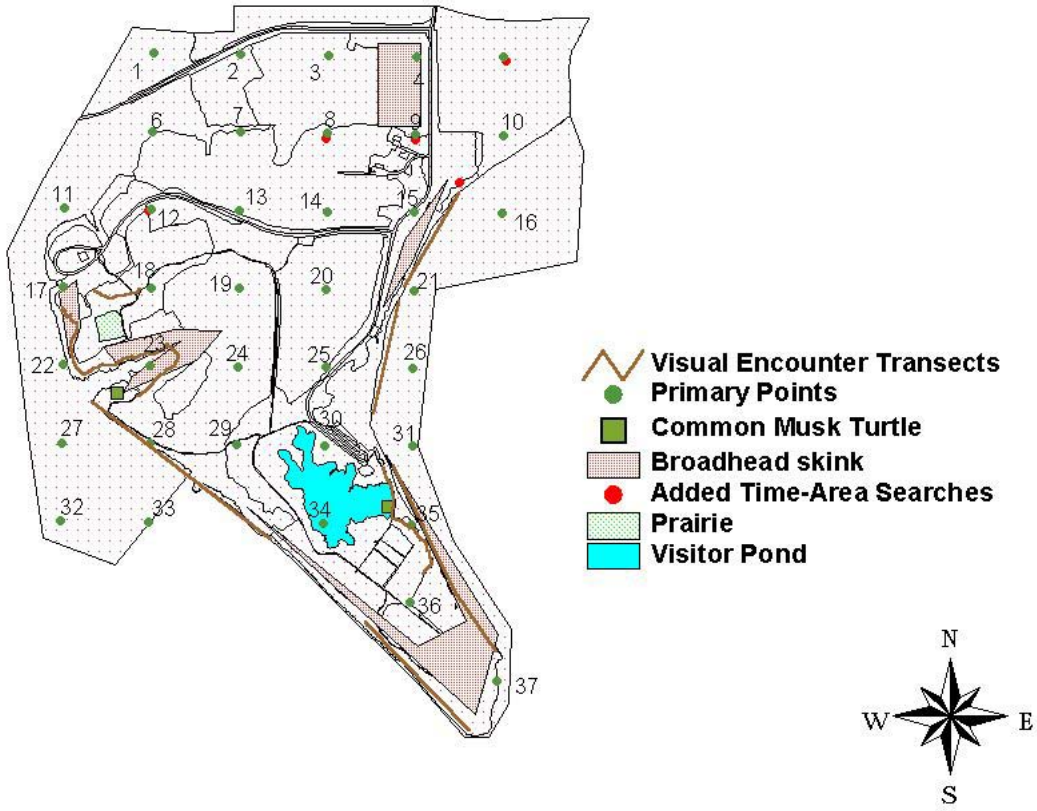

Figure 12. Distribution of the green water snake and the northern fence lizard at Arkansas Post National Memorial.

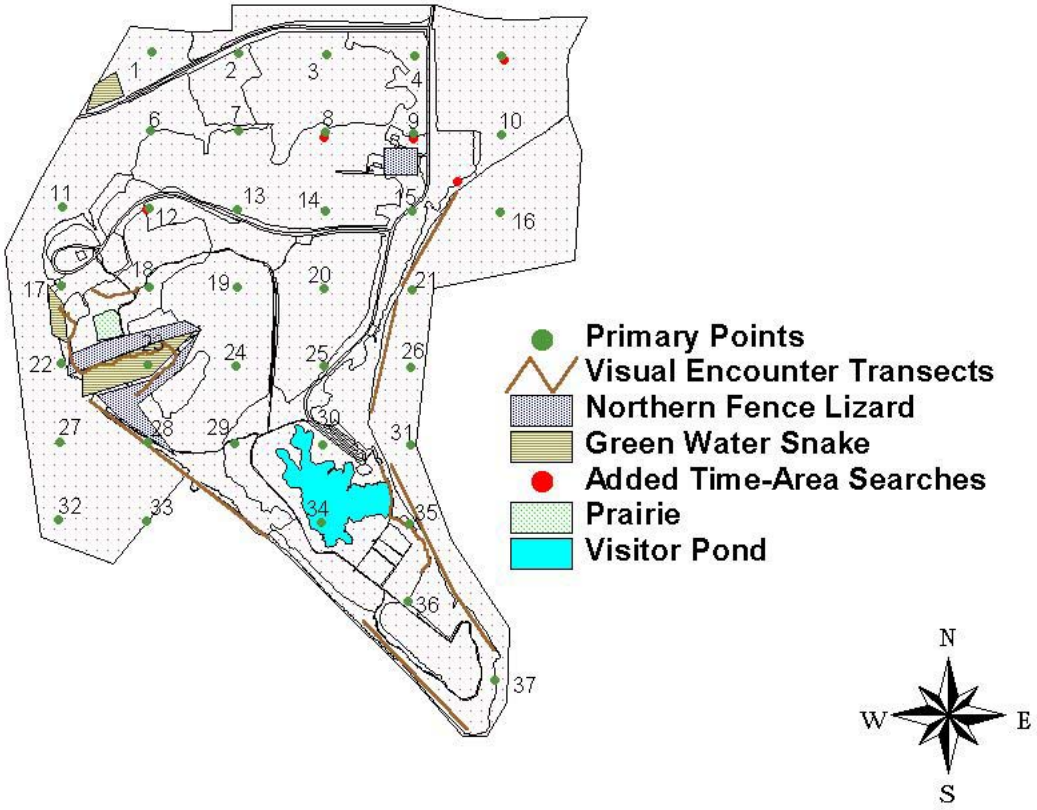

Figure 13. Distribution of the western cottonmouth and the southern leopard frog at Arkansas Post National Memorial.

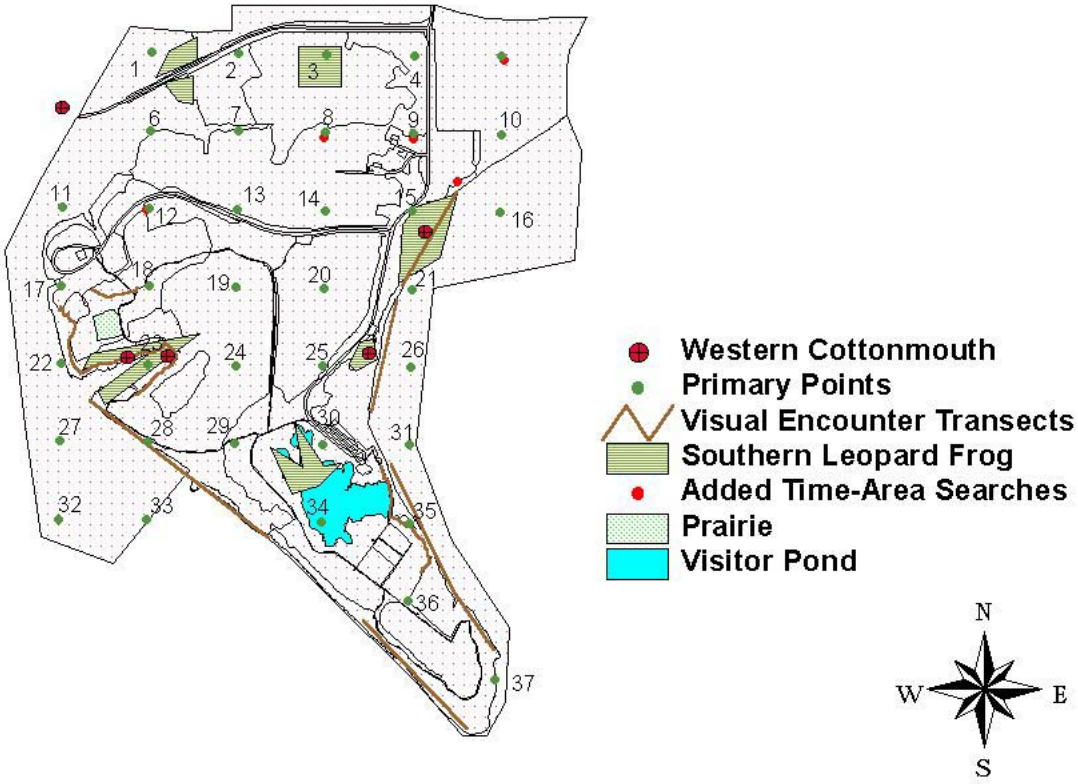

Figure 14. Distribution of the bullfrog and eastern narrowmouth toad at Arkansas Post National Memorial.

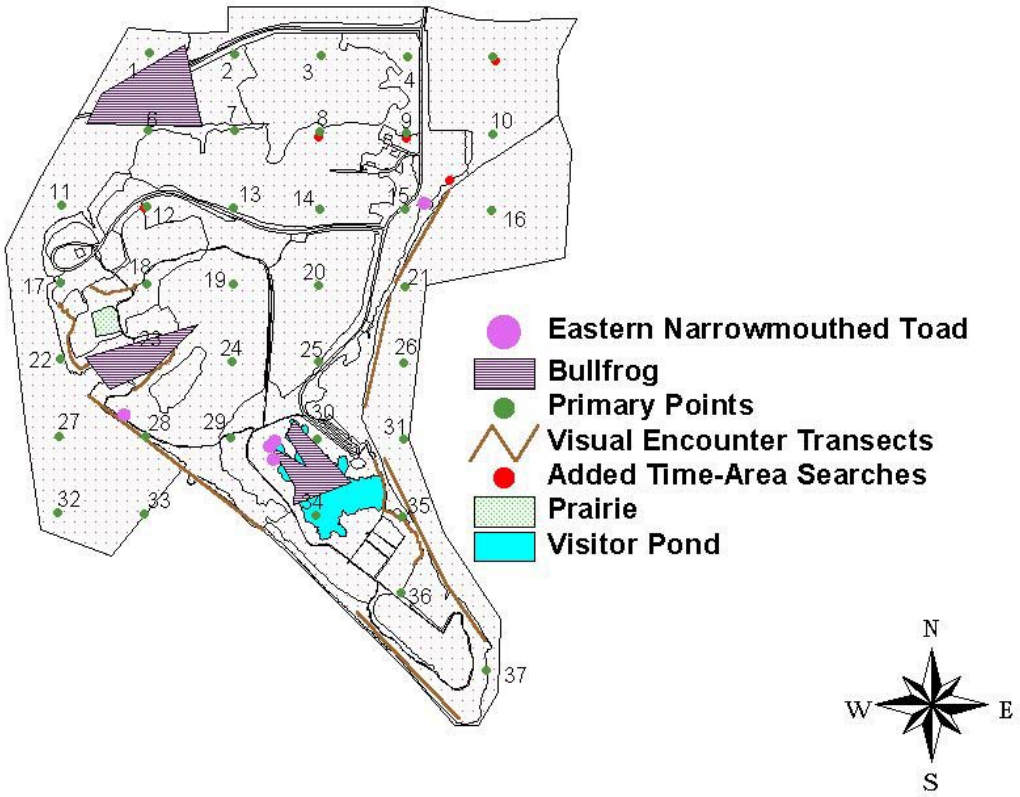

Figure 15. Overlay of all amphibian and reptilian ranges revealing centers of herpetofaunal species richness at Arkansas Post National Memorial.

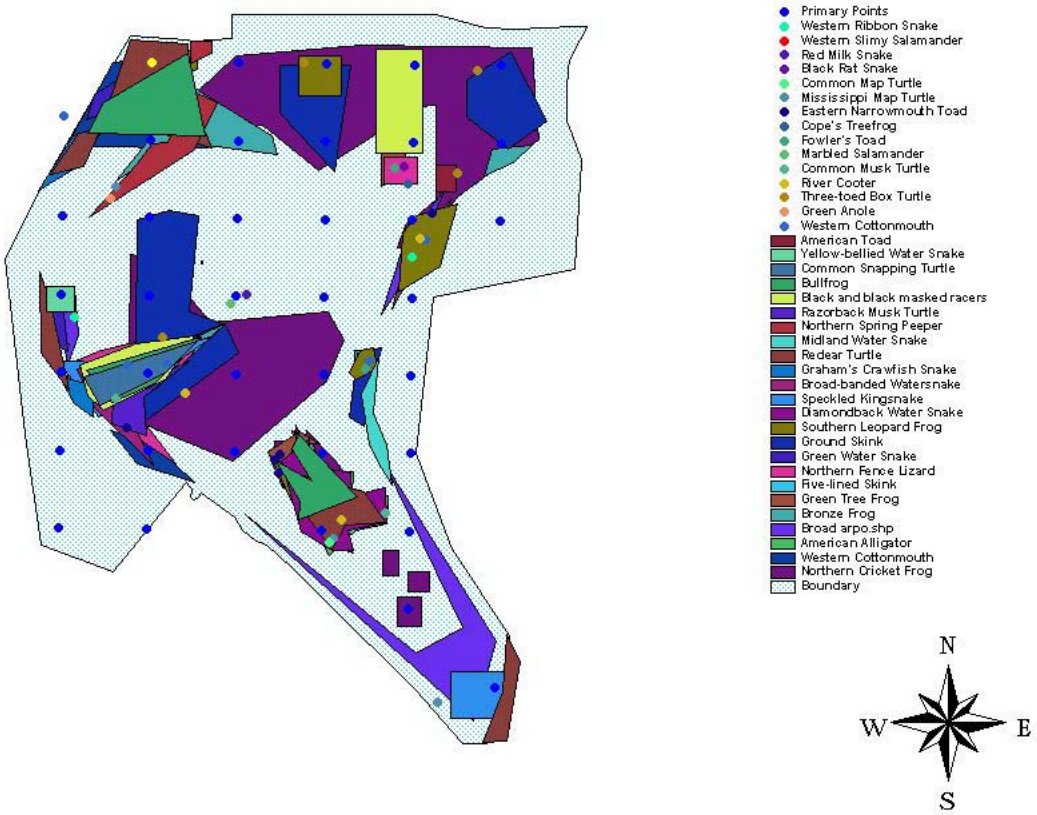

Figure 16. Overlay of all amphibian ranges revealing centers of amphibian species richness at Arkansas Post National Memorial.

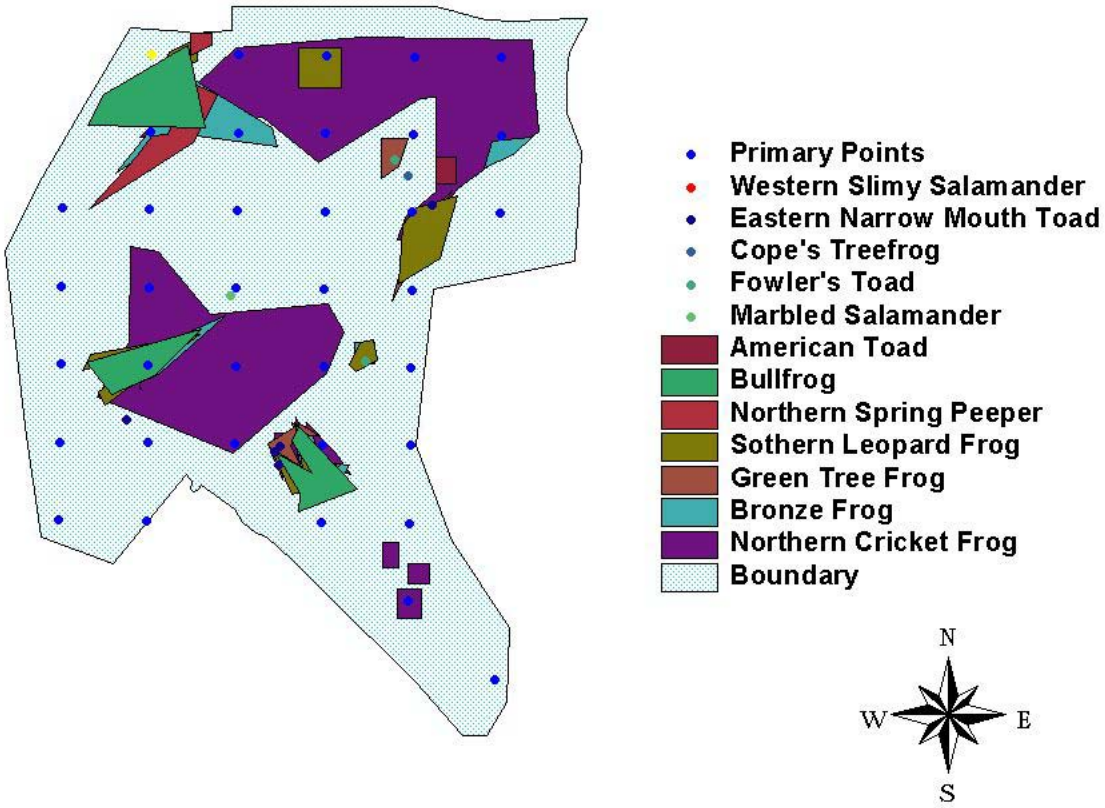

Figure 17. Overlay of all reptilian ranges revealing centers of reptilian species richness at Arkansas Post National Memorial.

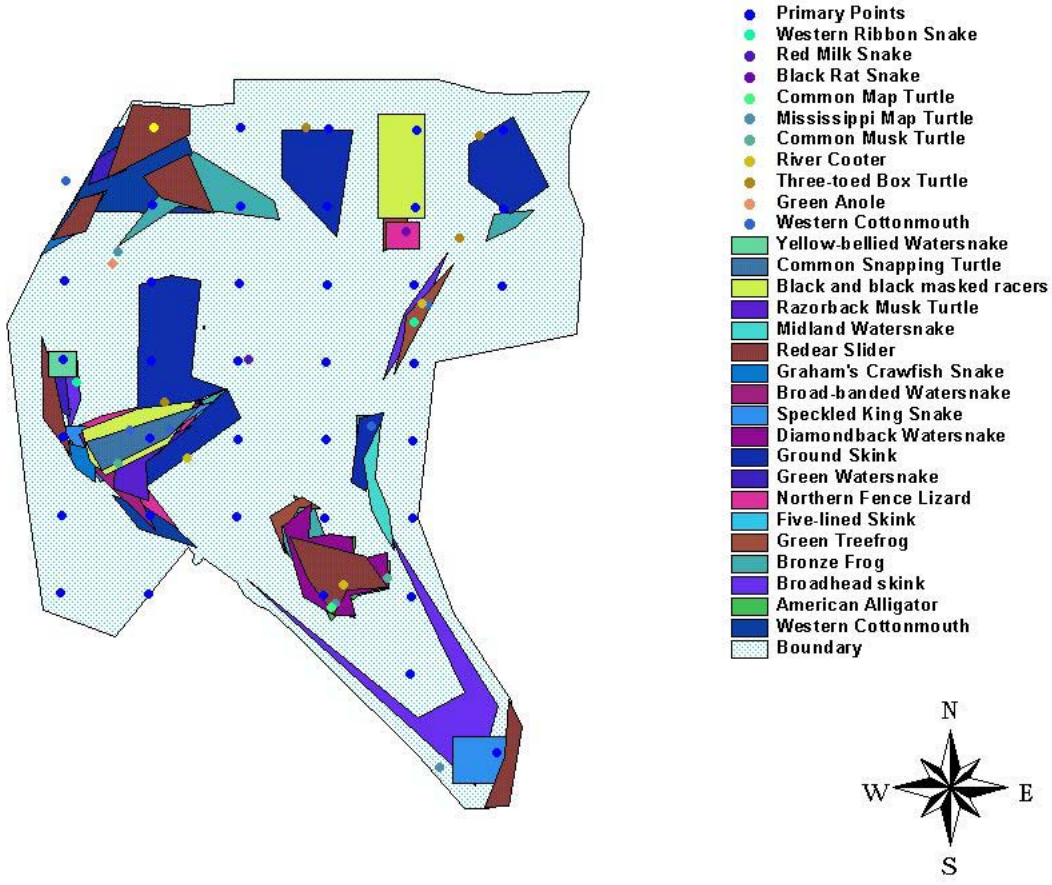

Figure 18. Photos of the American alligator nest and eggs at Alligator Slough, Arkansas Post National Memorial.